OFFICE OF MANNED SPACE FLIGHT PROGRAM DIRECTIVE	M-D ML 3200.098 (Project)	DATE JAN 24 1969

APOLLO APPLICATIONS
PROGRAM DIRECTIVE NO. 3D

TO : Distribution

FROM: DIRECTOR, APOLLO APPLICATION

SUBJECT: Change 1 to Apollo Applications Program Directive No. 3D

The attached changes are to be incorporated into the subject directive on a page-for-page substitution basis. This memorandum shall be attached to the basic document and become part of the directive. Substance of the changes is as follows:

(a) Deletion of Experiments S027 and M415 from AAP-1 and Experiments M479, T021 and T017 from AAP-2.

(b) Addition of Experiments M492, M493, M507, S009, S018, S020, S063, S073 and T013 to AAP-2.

(c) Identification of new numbering system and titles for the medical experiments.

(d) Experiment M113 has been identified as a primary objective for pre and post flight.

(e) Experiments are listed in order of priority within experiment groups with the exception of medical experiments which are listed in numerical order.

(f) The use of two stages of launch vehicle propulsion plus additional Service Module propulsion for orbit insertion.

(g) A payload enclosure configuration for AAP-2 has been identified.

Changes are underlined to facilitate identification.

Attachments
(Pages 2, 3, 6, 7, 8, 9 and 9A)

c. Conduct in-flight experiments in the areas of science, applications, technology, engineering and medicine.

d. Qualify man, evaluate his support requirements and determine human task performance capability on long duration manned space flight missions.

e. Obtain data on operations and system performance to support future earth orbital space station systems design and operations definition.

2.0 MISSION OBJECTIVES

2.1 Primary Objectives: The primary objectives of Mission AAP-1/AAP-2 are listed below. They may be amplified but not modified by the centers. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives will be cause to hold or cancel the mission until the malfunction has been eliminated.

a. Obtain data to evaluate space flight environmental effects on the crew of a mission duration up to 28 days (Experiments M071, M072, M073, M091, M092, M111, M113, M171).

b. Determine the feasibility of operating the Saturn I Workshop (Experiment M402 and elements of M487) as a habitable space structure for a period of up to 28 days from the AAP-1 launch date through evaluation of CM/SM/S-IVB/Airlock Module/Multiple Docking Adapter to include the following:

(1) Subsystems performance.
(2) Astronaut mobility and work capability in both intra- and extra-vehicular activity.

c. Leave the Saturn I Workshop in orbit for reactivation and reuse during subsequent missions extending up to 8 months after the AAP-1 launch.

2.2 Secondary Objectives: The secondary objectives of Mission AAP-1/AAP-2 are summarized below. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives may be cause to hold or cancel the mission as specified in the Mission Rules.

a. Demonstrate the feasibility of extending CM/SM mission duration through incorporation of additional expendables in the Service Module.

b. Verify the ability of mission ground support systems to support mission activities of extended duration.

c. Obtain engineering and technological data needed for development of advanced space vehicles and equipment (Experiments M487, M492, M493, M507, M508, M509, D008, D019, D020, D021, D022, T013, T018, T020, T025, T027).

d. Obtain data prerequisite to identification of earth resources and development of improved cartographic procedures (Experiment S101).

e. Obtain medical and biological data as required for evaluation of the effects of weightless ness on man (Experiments M074, M093, M131, M151, M172, T003, S015).

f. Obtain data in the area of bioscience and astronomy (Experiments S009, S018, S019, S020, S063, S073).

3.0 GENERAL FLIGHT PLAN

3.1 Launch:

a. AAP-1 is a manned flight involving a Saturn IB launch vehicle and a modified Block II CM/SM. It will be launched after AAP-2 from LC 34 at KSC at a time and azimuth to facilitate rendezvous with the AAP-2 Saturn I Workshop. The use of two stages of launch vehicle burning plus additional burning of the SM main propulsion system will be utilized for orbit insertion.

b. AAP-2 is an unmanned flight involving a Saturn IB launch vehicle with S-IVB stage modifications, an Airlock Module, a Multiple Docking Adapter and a Payload Enclosure. It will precede AAP-1 and will be launched from LC 37B at KSC into approximately a 185 x 190 n. mi. orbit having a nominal inclination of 35°. The workshop and spacecraft orbit will be circularized at 210 n. mi.

4.2 Payload Enclosure: A payload shroud will provide an aerodynamic enclosure for AAP-2. The payload shroud will be a conical section similar to the AS-203 nose cone with an additional cylindrical section enclosing and supporting the payload. The shroud will be jettisoned over the nose during the early phase of S-IVB powered flight.

4.3 Airlock Module/Multiple Docking Adapter (AM/MDA): The Airlock Module/Multiple Docking Adapter will:

a. Provide access to the S-IVB after it is in orbit.

b. Provide the two-gas atmosphere control system required to pressurize the Saturn I Workshop and an environmental conditioning system for the AM/MDA, Saturn I Workshop and the CM and LM-A when they are hard docked to the MDA.

c. Provide a power distribution system to transfer power as required to the CM, S-IVB, MDA, AM and experiments.

d. Provide for contingency power distribution in either direction between the CM/SM and the AM/MDA and for contingency power distribution to the LM/ATM when it is hard docked to the MDA.

e. Provide for experiment support for both the AAP-1 and AAP-2 flights as well as that required for execution of AAP-3A and AAP-3/AAP-4.

f. Carry instrumentation for operational evaluation of the AM/MDA/Saturn I Workshop as a habitable space structure.

g. Provide for storage in the MDA and AM of all experiments designated for transport therein during powered flight.

h. Provide for execution in the MDA of applicable primary objective medical experiments (M071, M092, M171) together with essential support hardware prior to their relocation and activation in Saturn I Workshop.

i. Provide in the MDA for contingency execution (Workshop inaccessible) of essential elements of M487 and those secondary experiments which can be accommodated without requiring MDA system and experiment design changes for contingency operation.

j. Provide two radial docking ports and an inline docking port in the MDA. One radial port will permit docking to the MDA of a LM/ATM. The inline port will provide for docking of a CM/SM. The use of the second radial port to provide a backup capability to dock the CM/SM is under study.

k. Provide sufficient in-orbit monitoring and command capability for the storage period to determine equipment status.

4.4 Spacecraft: The AAP-1 CM/SM will be a standard Block II Apollo configuration modified to:

a. Provide for electrical power distribution from the Airlock and for contingency power transfer to the Airlock.

b. Carry and support experiment hardware as required.

c. Provide a low pressure GOX internal umbilical to the Airlock EVA System.

d. Provide for use of the SM RCS System to circularize the orbit of the cluster and as a backup retrofire system.

e. Provide expanded SM RCS propellant capabilities to support the AAP-1/AAP-2 Mission.

f. Carry O_2, N_2 and H_2 consumables to support the AAP-1/AAP-2 Mission for 28 days.

g. Provide a two-gas atmosphere pressure regulation system for the AM/MDA/Saturn I Workshop activation and operation for a 28 day mission.

h. Provide SPS propellant capability for utilization of SM main propulsion system for orbit insertion.

5.0 EXPERIMENTS

The following experiments are assigned to the AAP-1/AAP-2 Mission and are listed in order of priority within experiment groups with the exception of medical experiments which are listed in numerical order.

5.1 AAP-1

Objective	No.	Title	Dev. Center	Launch Location
Medical				
P	M071 (M052)	Mineral Balance	MSC	CM
P	M072 (M052)	Bone Densitometry (Pre & Post Flight)	MSC	NA
P	M073 (M052)	Bioassay of Body Fluids	MSC	CM
S	M074 (M056)	Specimen Mass Measurement	MSC	CM

Objective	No.	Title	Dev. Center	Launch Location
Applications				
S	S101	Multiband Photography	MSC	MDA
Technology				
S	T027	ATM Contamination Measurement	MSFC	AM
S	T025	Coronagraph Contamination Measurement	MSC	AM
S	D021	Expandable Airlock Technology	AF/MSFC	AM/EXT
S	T013	Crew/Vehicle Disturbance	LaRC	MDA/OWS
S	M493	Electron Beam Welding	MSFC	MDA
S	M492	Tube Joining Assemblies	MSFC	MDA
S	D022	Expandable Structures for Recovery	AF/MSFC	AM/EXT
Science				
S	S019	UV Stellar Astronomy	MSC	AM
S	S018	Micrometeorite Collection	MSC	AM
S	S073	Gegenschein/Zodiacal Light	MSC	AM
S	S020	UV/X-ray Solar Photography	MSC	AM
S	S009	Nuclear Emulsion	MSC	MDA
S	S063	UV Airglow Horizon Photography	MSC	AM

* Elements of this experiment vital to the accomplishment of the 28-day mission are to be considered primary objectives.

5.3 Implementation: The following instructions are established for payload integration and mission planning activities associated with the above experiments:

a. Integrate and include in operational mission planning all experiments assigned to AAP-1. In addition, integrate into the CM the return payload requirements of those experiments assigned to AAP-2.

b. Integrate and conduct mission planning for all experiments assigned to AAP-2. This integration effort should include further assessments of the mission compatabilities of these experiments from weight, volume and time-line considerations. Where experiment operations are constrained by available mission crew time, consideration should be given to utilizing future missions to complete such experiments.

c. All experiments should be developed and delivered on a schedule which will provide flight hardware to support fit and function tests of experiments to verify the experiment carrier interface integrity in the separate flight modules where they are carried, performed and returned. Need dates will be as established and reported in reference (a).

d. The following additional information is provided to clarify current experiments configuration.

(1) The task board requirements for D020 will be provided by M508. In addition, consideration should be given to combining M171 task board requirements into M508.

(2) Elements of M074, M093 and M172 are required for performance of M071, M073, M092 and M171.

(3) M508 assumes the use of the lighter weight constant volume suit rather than the Litton hard suit.

(4) S101 is based on the use of six Hasselblad cameras.

(5) T020 assumes the use of the gas bottle from M509. M509 is based on the use of one gas bottle that will be repressurized in orbit. The feasibility of repressurizing this gas bottle is under study by MSFC.

(6) D022 is based on conducting this experiment during a single EVA on AAP-2. Additional samples of this experiment can be retrieved during EVA on AAP-3A.

(7) T013 will not be performed until the AAP-3/AAP-4 Mission. AAP-2 shall be configured to support T013.

DISTRIBUTION:

OMSF

M/Mueller
MD/Mathews
M-1/Bowman
MDM/Bogart
MA/Phillips
MA-1/Schaibley
MA-2/Keegan
MAL/Beattie
MAL/Grosz
MAO/Holcomb (5)
MAP/Skaggs (2)
MAR/White (7)
MAS/Wagner (4)
MAS/Penn
MAT/Day (5)
MC/Freitag
MCL/Ashley
MM/Humphreys (2)
MM/McLaughlin
M-N/Alibrando
MO/Turnock
MO/Stevenson (5)
MOR/Brown (10)
MOR/Chandler
MP/Kubat (2)
MPP/Rafel (2)
MPR/Johnson
MS/White
MSR/Davis
MTD/Lord (9)
MTG/Hall
MTX/Armstrong
MTX/Hall
MTY/Lohman
ML/Schneider
MLD/Disher
ML-1/Levenson
MLA/Culbertson (12)
MLO/Edwards (5)
MLP/Field (12)
MLP-4/Koutsandreas (5)
MLP-5/Little (3)
MLR/Cohen (5)
MLS/Hagner (7)
MLT/Savage (14)
MLV/Fero

OSSA

S/Naugle
SD/Nicks
SA/Jaffe
SB/Reynolds
SE/Johnson
SG/Mitchell
SL/Hearth
SV/Mahon

OART

R/Beggs
R/Eggers
RD/Lundin
RDA/Harper
RB/Jones
RE/Sullivan
RF/Ginter
RN/Woodward
RFE/Novik (5)
RP/Tischler
RV/Ames

XP/Jones (2)

OTDA

T/Truszynski
TD/Brockett
TA/Morrison
TS/Pozinsky
TR/Bryant

OPPA

PT/Maggin

GSFC

110/Stroud
800/Covington
810/Roberts
820/Wood
550/Vonbun

KSC

AA/Morgan (75)

MSC

KA/Thompson (100)

MSFC

DIR/Von Braun
EX/Maus
I-DIR-O/Connor
R-DIR/Weidner
I-S/AA-MGR/Belew
I-I/IB-MGR/Teir
I-V-MGR/James
I-MO-MGR/Speer
I-RM-M/Goldston (70)

LaRC

DIR/Cortright (3)

LeRC

DIR/Silverstein (3)

ERC

DIR/Elms (3)

ARC

DIR/Allen (3)

General Electric

Lyman
Demos (2)

OFFICE OF MANNED SPACE FLIGHT

APOLLO APPLICATIONS PROGRAM

PROGRAM DIRECTIVE NO. 3D

FLIGHT MISSION DIRECTIVE FOR AAP-1/AAP-2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON 25, D. C.

OFFICE OF MANNED SPACE FLIGHT PROGRAM DIRECTIVE	M-D ML 3200.098 (Project)	DATE NOV 21 1968

APOLLO APPLICATIONS
PROGRAM DIRECTIVE NO. 3D

TO : Distribution

FROM: for DIRECTOR, APOLLO APPLICATION

SUBJECT: Flight Mission Directive for Mission AAP-1/AAP-2

REF : (a) MSF Schedules Vol. I, Level 1 Schedule Summary, (latest edition)
(b) Apollo Flight Mission Assignments Directive, M-D MA 500-11, dated June 1968.
(c) Apollo Applications Test Requirements Document, NHB 8080.3, dated October 13, 1967
(d) Apollo Applications Program Directive No. 11 dated February 26, 1968
(e) Reliability and Quality Assurance Plan, NHB 5300.5, dated May 1967

PURPOSE: This directive defines AAP requirements and responsibilities to initiate those actions prerequisite to execution of the AAP-1/AAP-2 Mission. Commitment of funds or technical effort associated with implementation of this directive must be in accordance with authorization provided by NASA Project Approval Documents. The mission is scheduled for launch as indicated in reference (a) in the event that the launch vehicles and spacecraft assigned to the Apollo-Saturn missions, reference (b), are not required to support the mainline Apollo Program. This directive supersedes Apollo Applications Program Directive No. 3C dated January 31, 1968, and Change 1 dated May 14, 1968.

1.0 MISSION PURPOSE

The purposes of the AAP-1/AAP-2 Mission are as follows:

a. Conduct a low altitude, medium inclination earth orbital mission with a crew of three men, open ended to 28 days duration using a spent S-IVB stage as a Saturn I Workshop.

b. Provide for reactivation and reuse of the Saturn I Workshop during subsequent missions extending up to 8 months after the AAP-1 launch.

c. Conduct in-flight experiments in the areas of science, applications, technology, engineering and medicine.

d. Qualify man, evaluate his support requirements and determine human task performance capability on long duration manned space flight missions.

e. Obtain data on operations and system performance to support future earth orbital space station systems design and operations defintion.

2.0 MISSION OBJECTIVES

2.1 Primary Objectives: The primary objectives of Mission AAP-1/AAP-2 are listed below. They may be amplified but not modified by the centers. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives will be cause to hold or cancel the mission until the malfunction has been eliminated.

a. Obtain data to evaluate space flight environmental effects on the crew of a mission duration up to 28 days (Experiments M050, M051, M052).

b. Determine the feasibility of operating the Saturn I Workshop (Experiment M402 and elements of M487) as a habitable space structure for a period of up to 28 days from the AAP-1 launch date through evaluation of CM/SM/S-IVB/**Airlock Module/Multiple Docking Adapter to include the following:**

(1) Subsystems performance.
(2) Astronaut mobility and work capability in both intra- and extra-vehicular activity.

c. Leave the Saturn I Workshop in orbit for reactivation and reuse during subsequent missions extending up to 8 months after the AAP-1 launch.

2.2 Secondary Objectives: The secondary objectives of Mission AAP-1/AAP-2 are summarized below. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives may be cause to hold or cancel the mission as specified in the Mission Rules.

a. Demonstrate the feasibility of extending CM/SM mission duration through incorporation of additional expendables in the Service Module.

b. Verify the ability of mission ground support systems to support mission activities of extended duration.

c. Obtain engineering and technological data needed for development of advanced space vehicles and equipment (Experiments M415, M479, M487, M508, M509, D008, D019, D020, D021, D022, T003, T017, T018, T020, T021, T025, T027).

d. Obtain data prerequisite to identification of earth resources and development of improved cartographic procedures (Experiment S065/S101).

e. Obtain medical and biological data as required for evaluation of the effects of weightlessness on man (Experiments M018, M053, M055, M056, M058, M113, S015).

f. Obtain stellar astronomy data (Experiments S019, S027).

3.0 GENERAL FLIGHT PLAN

3.1 Launch:

a. AAP-1 is a manned flight involving a Saturn IB launch vehicle and a modified Block II CM/SM. It will be launched after AAP-2 from LC 34 at KSC at a time and azimuth to facilitate rendezvous with the AAP-2 Saturn I Workshop. The use of two stages of launch vehicle burning plus additional burning of the SM main propulsion system for orbit insertion is under study for this mission.

b. AAP-2 is an unmanned flight involving a Saturn IB launch vehicle with S-IVB stage modifications, an Airlock Module, a Multiple Docking Adapter and a Payload Enclosure. It will precede AAP-1 and will be launched from LC 37B at KSC into approximately a 185 x 190 n. mi. orbit having a nominal inclination of 35°. The workshop and spacecraft orbit will be circularized at 210 n. mi.

3.2 Spacecraft Flight Profile: The launch timing and launch azimuth of the AAP-1 spacecraft will be selected to permit expeditious rendezvous with the AAP-2 Saturn I Workshop. After the requisite transitional maneuvers to rendezvous with the Saturn I Workshop, the CM/SM will dock to the axial port of the Multiple Docking Adapter. SM RCS propulsion will be used to circularize the cluster orbit at 210 n. mi. The Saturn I Workshop will be activated for habitation. The remainder of the 28-day mission will be devoted to the conduct of experiments and evaluation of the Saturn I Workshop systems. The CM will then return to earth leaving the Saturn I Workshop in earth orbit for use in subsequent planned revisit missions.

3.3 Interface with Future AAP Missions: Since the plans for execution of primary mission objectives of subsequent missions are dependent on the operational capability of the hardware placed in orbit by AAP-1/AAP-2, it is imperative that the following requirements be considered concomitantly with the AAP-2 S-IVB stage modification and the AM/MDA design and development.

a. Revisitation and activation to manning performance levels of the cluster Electrical Power System and reactivation of the Environmental Control System for a period of up to 56 days for each of the following revisits:

   (1) AAP-3A
   (2) AAP-3/AAP-4

b. Incorporation of systems status monitoring equipment for ground interrogation during unmanned orbital storage.

c. Radial docking of an unmanned Lunar Module (ascent stage)/ Apollo Telescope Mount (LM/ATM). Contingency transfer of electrical power between LM/ATM and the Airlock.

d. Stabilization during docking operations for revisit missions and the possible exercise of intermittent attitude control during orbital storage periods.

e. Accommodation of ancillary hardware for conduct of additional experiments carried on later missions.

3.4 Recovery: Water recovery to be developed for the CM consistent with the above-stated profile characteristics and the normal recovery constraints associated with the deployment of recovery forces and the local lighting conditions at the time of recovery.

3.5 Mission Support Requirements: These requirements will be supplied in a "Program Support Requirements" document to be issued by the Operations Support Office, Mission Operations, OMSF, not later than four months prior to launch.

4.0 CONFIGURATION

4.1 Launch Vehicles: Saturn I-B launch vehicles as assigned by reference (a) will be used for the AAP-1 and AAP-2 flights. With the exception of the AAP-2 S-IVB, modifications will be limited to the minimum necessary to achieve proper trajectory stabilization and control. The AAP-2 S-IVB will be modified to incorporate the following:

a. Saturn I Workshop (Sat I WS)

(1) Propulsion system passivation.
(2) LH_2 tank conversion for habitation.
(3) Micrometeoroid bumper.
(4) Fire retardant liner.
(5) Ancillary hardware to support experiments designated for execution in the Saturn I Workshop.

b. An articulated solar cell power system to supply electric power to the Airlock power distribution system after injection into orbit.

c. A workshop attitude control system (WACS) for S-IVB attitude control after injection into orbit. The WACS will provide for the following:

(1) Stabilization during rendezvous and docking operations.
(2) Attitude control for the AAP-1/AAP-2 and AAP-3A Missions durations.
(3) Intermittent attitude control during the orbital storage periods between missions.
(4) Stabilization during revisit, rendezvous and docking operations.

4.2 Payload Enclosure: A payload enclosure will provide an aerodynamic shroud for AAP-2. It will be jettisoned during powered flight. The specific configuration and jettison mode will be determined by studies now being performed.

4.3 Airlock Module/Multiple Docking Adapter (AM/MDA): The Airlock Module/Multiple Docking Adapter will:

a. Provide access to the S-IVB after it is in orbit.

b. Provide the two-gas atmosphere control system required to pressurize the Saturn I Workshop and an environmental conditioning system for the AM/MDA, Saturn I Workshop and the CM and LM-A when they are hard docked to the MDA.

c. Provide a power distribution system to transfer power as required to the CM, S-IVB, MDA, AM and experiments.

d. Provide for contingency power distribution in either direction between the CM/SM and the AM/MDA and for contingency power distribution to the LM/ATM when it is hard docked to the MDA.

e. Provide for experiment support for both the AAP-1 and AAP-2 flights as well as that required for execution of AAP-3A and AAP-3/AAP-4.

f. Carry instrumentation for operational evaluation of the AM/MDA/Saturn I Workshop as a habitable space structure.

g. Provide for storage in the MDA of all experiments designated for transport therein during powered flight.

h. Provide for execution in the MDA of all primary objective medical experiments (M050, M051, M052) together with essential support hardware prior to their relocation and activation in Saturn I Workshop.

i. Provide in the MDA for contingency execution (Workshop inaccessible) of essential elements of M487 and those secondary experiments which can be accommodated without requiring MDA system and experiment design changes for contingency operation.

j. Provide two radial docking ports and an inline port. One radial port will permit docking to the MDA of a LM/ATM. The inline port will provide for docking of a CM/SM. The use of the second radial port to provide a backup capability to dock the CM/SM is under study.

k. Provide sufficient in-orbit monitoring and command capability for the storage period to determine equipment status.

4.4 Spacecraft: The AAP-1 CM/SM will be a standard Block II Apollo configuration modified to:

a. Provide for electrical power distribution from the Airlock and for contingency power transfer to the Airlock.

b. Carry and support experiment hardware as required.

c. Provide a low pressure GOX internal umbilical to the Airlock EVA system.

d. Provide for use of the SM RCS system to circularize the orbit of the cluster and as a backup retrofire system.

e. Provide expanded SM RCS propellant capabilities to support the AAP-1/AAP-2 Mission.

f. Carry O_2, N_2 and H_2 consumables to support the AAP-1/AAP-2 Mission for 28 days.

g. Provide a two-gas atmosphere pressure regulation system for the AM/MDA/Saturn I Workshop activation and operation for a 28 day mission.

5.0 EXPERIMENTS

The following experiments are assigned to the AAP-1/AAP-2 Mission. They are listed in relative order of priority by flight.

5.1 AAP-1

Objective	No.	Title	Dev. Center	Launch Location
P	M052	Bone and Muscle Changes	MSC	CM
S	M056	Non-Gravimetric Mass Measurement	MSC	CM
S	S015	Zero-G Single Human Cell	MSC	CM
S	S027*	Galactic X-ray Mapping	MSFC	IU
S	M415*	Thermal Control Coatings	MSFC	IU/EXT
S	T018	Precision Optical Tracking	MSFC	IU/EXT
S	D008	Radiation in Spacecraft	AF/MSC	CM
S	M113	Blood Volume/Red Cell Life Span	MSC	NA

* These experiments will not be carried if AAP-1 utilizes the SM propulsion system for orbital insertion.

5.2 AAP-2

Objective	No.	Title	Dev. Center	Launch Location
P	M402	Orbital Workshop	MSFC	S-IVB
S*	M487	Habitability/Crew Quarters	MSFC	S-IVB/MDA
P	M051	Cardiovascular Function Assessment	MSC	MDA
P	M050	Metabolic Activity	MSC	MDA
P	M052	Bone and Muscle Changes	MSC	MDA
S	M056	Non-Gravimetric Mass Measurement	MSC	MDA
S	M058	Human Mass Measurement Device	MSC	MDA
S	M018	Vectorcardiogram	MSC	MDA
S	M055	Time and Motion Study	MSC	MDA
S	D019	Suit Donning and Sleep Station Evaluation	AF/MSFC	MDA/OWS
S	D020	Alternate Restraints Evaluation	AF/MSFC	MDA
S	M053	Human Vestibular Function	MSC	MDA
S	T025	Coronagraph Contamination Measurement	MSC	MDA
S	T027	ATM Contamination Measurement	MSFC	MDA
S	M509	Astronaut Maneuvering Equipment	MSC	MDA
S	T020	Foot Controlled Maneuvering Unit	LaRC	MDA
S	M508	EVA Hardware Evaluation	MSC	MDA
S	D021	Expandable Airlock Technology	AF/MSFC	AM/EXT
S	S065/S101	Multiband Terrain Photography (Hand Held) and Multiband Photography	MSC	MDA
S	T003	In-Flight Nephelometer	ERC	MDA
S	M479	Zero-G Flammability	MSC	MDA
S	T021	Meteoroid Velocity	MSC	AM/EXT
S	T017	Meteoroid Impact & Erosion	MSC	AM/EXT
S	D022	Expandable Structures for Recovery	AF/MSFC	AM/EXT
S	S019	UV Stellar Astronomy	MSC	MDA

* Elements of this experiment vital to the accomplishment of the 28-day mission are to be considered primary objectives.

5.3 Implementation: The following instructions are established for payload integration and mission planning activities associated with the above experiments:

a. Integrate and include in operational mission planning all experiments assigned to AAP-1. In addition, integrate into the CM the return payload requirements of those experiments assigned to AAP-2.

b. Integrate and conduct operational mission planning for all experiments assigned to AAP-2.

c. If the integration activities indicate that an experiment cannot be accommodated due to AAP-2 weight and volume constraints, consideration should be given to stowing it in the spacecraft for subsequent operation in the Saturn I Workshop (SM storage would require EVA retrieval).

d. All experiments should be developed on a schedule which will provide flight hardware to support fit and function tests of experiments in the separate flight modules. Need dates will be as established and reported in reference (a).

e. The following additional information is provided to clarify current experiment configuration:

(1) Experiment M507 (Gravity Substitute Work Bench) was not identified in the above list or in the September 26, 1968, baseline but studies and primary considerations for inclusion of the experiment on AAP-2 are required since it cannot fly on any other AAP mission.

(2) The task board requirements for D020 will be provided by M508. In addition, consideration is being given to combining M050 task board requirements into M508.

(3) Elements of M018, M056, and M058 are required for performance of M050, M051, and M052.

(4) M508 in the above list assumes the use of lighter weight constant volume suit other than the Litton hard suit. Final decision is under discussion between sponsoring program office and AAP office.

(5) Consideration is being given to combining S065 and S101.

(6) S018 was not identified in the above list or in the September 26, 1968, baseline pending reassessment of its compatibility for AAP-2.

6.0 SUPPORTING GROUND TEST CONSTRAINTS

Test program will be conducted in accordance with the Apollo Applications Test Requirements document (reference (c)) and appropriate test specifications. Mission Requirements documents prepared by the centers in support of these missions will identify by inclusion or reference the test constraints which must be lifted prior to mission execution.

6.1 Qualification: **Components of the spacecraft, launch vehicles, payload enclosure, SLA, S-IVB/Airlock Module/Multiple Docking Adapter, flight experiment hardware and associated support systems whose failure would jeopardize** either crew safety (Category I) or the accomplishment of a primary mission objective (Category II) and which have not been flight tested will be ground qualified and/or certified prior to launch as described in Appendix D to reference (c). Basic Apollo hardware which has been flight tested (i.e., CM/SM) will be subjected to additional ground qualification and/or certification tests as required to provide confidence in meeting the long duration and other pertinent AAP requirements.

6.2 Launch Vehicles: The following flight stage tests will be performed on the AAP-1 and AAP-2 launch vehicles:

a. Manufacturing checkout of the IU's and S-IB and S-IVB flight stages.

b. Static test of the S-IB and S-IVB flight stages.

c. Post static checkout of the S-IB and S-IVB flight stages.

d. Post storage checkout of IU's and S-IB and S-IVB flight stages.

e. KSC integrated prelaunch tests of the IU's and **S-IB and S-IVB** flight stages.

6.3 Payload Enclosure (PLE): The following ground tests will be performed on the AAP-2 PLE:

a. Development and qualification tests.

b. Manufacturing checkout and acceptance tests.

c. KSC preflight checkout tests.

6.4 Airlock Module with Multiple Docking Adapter: The Airlock Module with Multip Docking Adapter shall be fully qualified to support manned operations. In support of this requirement, the following ground tests will be performed:

a. Airlock Module:

(1) Development tests.
(2) Qualification and/or certification tests as required to meet AAP mission requirements (including the subsequent reuse and revisit missions).
(3) Systems tests.
(4) Manufacturing checkout and acceptance tests.
(5) KSC prelaunch tests.

b. Multiple Docking Adapter:

(1) Development tests.
(2) Qualification and/or certification tests as required to meet AAP mission requirements (including the subsequent reuse and revisit missions).
(3) Experiment payload integration tests.
(4) Manufacturing checkout and acceptance tests.
(5) KSC prelaunch tests.

c. AM/MDA: Integrated systems tests.

6.5 AAP-2 S-IVB: The AAP-2 S-IVB shall be fully qualified to support manned operations in earth orbit. In support of this requirement, the following ground tests will be performed:

a. **Saturn I Workshop Modifications: The stage as modified for powered** flight with selected pre-installed hardware for conversion to an Orbital Workshop will require:

(1) Development Tests.
(2) Manufacturing and acceptance tests.
(3) Qualification and/or certification tests as required to meet AAP mission requirements (including the subsequent reuse and revisit missions).
(4) Integrated systems tests.
(5) Static tests.
(6) Post static test checkout.
(7) KSC prelaunch tests.

b. Solar Array Modifications: The solar array system will require:

(1) Development tests.
(2) Qualification tests.
(3) **Airlock Module/S-IVB systems integration tests.**
(4) Manufacturing checkout and acceptance tests.
(5) KSC prelaunch tests.

c. Workshop Attitude Control System (WACS): The WACS will require:

(1) Development tests.

(2) Qualification tests.
(3) Integrated systems tests.
(4) Manufacturing and acceptance tests.
(5) KSC prelaunch tests

6.6 AAP Experiments: The following ground tests will be performed:

a. Experiment development tests.

b. Qualification tests for each experiment.

c. Factory checkout and acceptance test of experiment and associated support systems.

d. Payload integration tests of experiment and associated support systems with carriers.

e. Fit and function tests of experiments flight hardware in flight modules prior to module shipment to KSC.

f. KSC prelaunch tests.

6.7 Spacecraft: The following major flight article ground tests will be performed on the AAP-1 CM/SM:

a. Qualification and/or certification tests on the basic Apollo CM/SM as required to meet the long duration, crew safety and other pertinent AAP requirements.

b. Qualification tests for all AAP peculiar subsystems modifications to verify operation for the AAP-1/AAP-2 Mission.

c. Factory checkout and acceptance tests.

d. Integrated systems tests.

e. KSC prelaunch tests.

6.8 **Spacecraft LM Adaptor (SLA): The following ground tests will be performed** on the AAP-1 SLA:

a. Development tests.

b. Qualification tests.

c. Manufacturing checkout and acceptance tests.

d. KSC preflight checkout tests.

6.9 Integrated Systems Tests: Integrated systems tests will be conducted to verify that flight hardware is physically, functionally and operationally compatible with associated ground support systems and mating hardware in the cluster configuration. Cluster configuration tests will be conducted with flight articles where practicable and with flight configured prototypes, simulators or master gauges, as appropriate, when the interfacing flight article cannot be made available. The following flight hardware interfaces will be verified:

a. AM/MDA

b. CM/SM (AAP-1,AAP-3, AAP-3A) - AM/MDA

c. S-IVB - AM

d. LM/ATM - AM/MDA

6.10 Prior Flight Missions: All launch vehicle, and spacecraft test anomalies resulting from all previous missions which could degrade or interfere with primary objectives will be fully evaluated and corrected prior to the launch of AAP-1 or AAP-2.

6.11 Design Certification Review (DCR): An AAP DCR will be conducted to certify all new hardware and all changes from the standard Apollo hardware required for this mission. Basic Apollo hardware already certified in previous DCR's will be recertified as required to meet AAP extended life and/or performance requirements. This review will also include certification of experiments likely to affect flight worthiness, manned flight safety and/or primary mission objectives. The DCR shall be in accordance with Apollo Applications Program Directive No. 11 (reference (d)).

6.12 Certification of Flight Worthiness (COFW): An AAP COFW (reference (c) and (d) for each stage, SLA, PLE, IU, CM/SM, AM/MDA and the Saturn I Workshop is required prior to shipment from the factory and after static firing if appropriate. In addition, experiments whose failure would jeopardize crew safety (Category I) or the accomplishment of a primary mission objective (Category II) will also require preparation of a COFW. Final updated and signed COFW's by the program managers will be required at the Flight Readiness Review and close out of open items prior to launch will be in accordance with reference (d).

7.0 RELIABILITY AND QUALITY ASSURANCE

A Reliability and Quality Assurance Program will be conducted in accordance with the Reliability and Quality Assurance Plan (reference (e)) issued by AAP, R&QA, OMSF.

8.0 RESPONSIBILITIES

Center responsibilities for implementation of this mission are as follows:

8.1 MSFC:

a. Provide the Saturn IB launch vehicles and required vehicle and GSE modifications.

b. Develop the Saturn I Workshop (Experiment M402) to include AAP-2 S-IVB solar array installation, WACS, stage modifications and kit preparation as required.

c. Develop the AM and associated GSE.

d. Develop the MDA and associated GSE.

e. Develop assigned experiments and supporting hardware.

f. Integrate assigned experiments into the AAP-1 launch vehicle.

g. Integrate all experiments designated for transport in the AAP-2 flight.

h. Develop all launch vehicle telemetry and all signal conditioning equipment other than that associated with astronaut medical functions for the AM/MDA/Saturn I Workshop.

i. Provide in-house development support to MSC for selected portions of medical experiments.

j. Develop and integrate the payload enclosure with the AAP-2 payload.

k. Conduct overall systems engineering activities and associated mission systems equipment analysis to assure the compatability, as an integrated system, of flight hardware elements and GSE necessary to properly integrate and interface the overall stacked vehicle for each flight and cluster (this does not apply to the more detailed development responsibility associated with the Command and Service Module).

l. Provide launch vehicle performance constraints and systems data to MSC for mission planning.

m. Provide technical support to MSC in support of their development of crew training procedures and flight operations planning for the **AM/MDA/Saturn I Workshop and MSFC assigned/designated experiments.**

n. Provide technical support to KSC as required during the acceptance, modification, prelaunch checkout and launch phases of this mission for all hardware assigned to MSFC for development.

o. Provide test requirements which are suitable for KSC development of test procedures for MSFC end items.

p. Provide operational support tc MSC as required during AAP-1/AAP-2 flight operations.

8.2 MSC:

a. Provide the CM/SM and associated GSE for the AAP-1 Mission.

b. Develop systems modifications and associated hardware as required for the CM/SM to accomplish mission objectives.

c. Integrate experiments designated for transport in the AAP-1 CM/SM and provide for the return portion of AAP-2 experiments.

d. Provide SLA for AAP-1 launch.

e. Develop assigned experiments and supporting hardware.

f. Provide support to MSFC on CM/SM systems and operational elements as required for overall systems engineering to integrate and interface the overall stacked vehicle for each flight and the cluster.

g. Plan the mission to include mission design and develop the astronaut flight plan with appropriate inputs from as well as for MSFC as related to the Workshop, MDA, AM and MSFC assigned experiments.

h. Plan and execute flight control, experiment and recovery operations.

i. Train the astronaut crew.

j. Provide test requirements which are suitable for KSC development of test procedures for MSC end items.

k. Provide technical support to KSC as required during the acceptance, modification, checkout, prelaunch and launch phases of this mission.

8.3 KSC:

a. Prepare checkout procedures and conduct prelaunch checkout of the launch vehicles with the associated GSE.

b. Prepare checkout procedures and conduct prelaunch checkout of the spacecraft and experiment hardware for AAP-1 with the associated GSE.

c. Provide capability to install MSC and MSFC supplied kits and conduct modifications to Apollo hardware as required for execution at the launch site.

d. Prepare checkout procedures and conduct prelaunch checkout of the Airlock, MDA and experiment hardware for AAP-2 with the associated GSE.

e. Plan and execute space vehicle launch operations.

f. Provide technical support as required to MSC and MSFC concerning the KSC implementation of modifications to flight hardware and GSE hardware.

g. Prepare integrated space vehicle checkout procedures and conduct integrated checkout of the space vehicle with its associated ground support systems.

9.0 IMPLEMENTATION

The Mission Requirements document for Missions AAP-1/AAP-2, AAP-3A and AAP-3/AAP-4 dated June 14, 1968, jointly prepared by MSC and MSFC should be reviewed and updated to reflect revisions in this directive.

Subsequent changes and future revisions to center Mission Requirements documents noted above which conflict with the requirements stated herein will require coordination between the centers and the review and approval of the Apollo Applications Director. Other revisions to the center Mission Requirements documents will be coordinated between centers as required with ten copies submitted to the Director, Apollo Applications, Code ML, for information.

DISTRIBUTION:

OMSF

M/Mueller
MD/Mathews
M-1/Bowman
MDM/Bogart
MA/Phillips
MA-1/Schaibley
MA-2/Keegan
MAL/Beattie
MAL/Grosz
MAO/Holcomb (5)
MAP/Skaggs (7)
MAR/White (7)
MAS/Wagner (4)
MAS/Penn
MAT/Day (5)
MC/Freitag
MCL/Ashley
MM/Humphreys (2)
MM/McLaughlin
M-N/Alibrando
MO/Turnock
MO/Stevenson (5)
MOR/Brown (10)
MOR/Chandler
MP/Kubat (2)
MPP/Rafel (2)
MPR/Johnson
MS/White
MSR/Davis
MTD/Lord (9)
MTG/Hall
MTX/Armstrong
MTX/Hall
MTY/Lohman
ML/Luskin
MLD/Disher
ML-1/Levenson
MLA/Culbertson (12)
MLO/Edwards (5)
MLP/Field (12)
MLP-4/Koutsandreas (5)
MLP-5/Little (3)
MLR/Cohen (5)
MLS/Hagner (7)
MLT/Savage (14)
MLV/Fero

OSSA

S/Naugle
SD/Nicks
SA/Jaffe
SB/Reynolds
SE/Johnson
SG/Mitchell
SL/Hearth
SV/Mahon

OART

R/Beggs
R/Eggers
RD/Lundin
RDA/Harper
RB/Jones
RE/Sullivan
RF/Ginter
RN/Woodward
RFE/Novik (5)
RP/Tischler
RV/Ames

XP/Jones (2)

OTDA

T/Truszynski
TD/Brockett
TA/Morrison
TS/Pozinsky
TR/Bryant

OPPA

PT/Maggin

GSFC

110/Stroud
800/Covington
810/Roberts
820/Wood
550/Vonbun

KSC

AA/Morgan (75)

MSC

KA/Thompson (100)

MSFC

DIR/Von Braun
EX/Maus
I-DIR-O-Connor
R-DIR/Weidner
I-S/AA-MGR/Belew
I-I/IB-MGR/Teir
I-V-MGR/James
I-MO-MGR/Speer
I-RM-M/Goldston (70)

LaRC

DIR/Cortright (3)

LeRC

DIR/Silverstein (3)

ERC

DIR/Elms (3)

ARC

DIR/Allen (3)

General Electric

Demos (2)
Lyman